

PATENT SPECIFICATION

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(54) SWEETENING COMPOSITIONS AND PROCESS FOR PREPARING THE SAME

(71) We, AJINOMOTO CO., INC., a corporation organized under the law of Japan, of No. 7, 1-chome, Takara-cho, Chuo-Ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to sweetening compositions and to a process for preparing the same.

Recently, artificial sweeteners have become widely used in processed foods not only because of economical advantages but also because of other merits. Thus, by employing an artificial sweetener, we can expect to obtain a taste different from that of sucrose, to prevent increases in weight and diabetes, to prevent the browning of foodstuffs, and to prevent fermentation in foodstuffs caused by assimilation of a saccharide (such as sucrose) by microorganisms.

The use of dulcin and cyclamate has recently been prohibited in many countries because of their toxic properties, and therefore, sodium saccharin is now most frequently employed as an artificial sweetener. However, there are certain failings in the use of sodium saccharin; in particular, the potency of the sweetness does not increase corresponding to an increase in the concentration employed, whereas the unpleasant after-taste characteristic of sodium saccharin increases in strength corresponding to an increasing concentration.

We have now found that, when sodium saccharin is mixed with particular quantities of D- or DL-tryptophan, the intensity of sweetness is increased because of a synergistic effect, and at the same time the quality of taste is improved with a reduction in, or elimination of, the unpleasant after-taste.

Thus, according to one aspect of the present invention there is provided a composition

suitable for the sweetening of edible materials, which comprises a mixture of 1 part by weight of a saccharin, preferably sodium saccharin, and from 0.05 to 100 parts by weight of D-tryptophan or from 0.10 to 200 parts by weight of DL-tryptophan.

A process for preparing the composition by intimately admixing the ingredients, and a method of sweetening edible products by adding the composition to the edible product constitute other aspects of the present invention.

The present invention will be illustrated by the following Experiments. The people used in the panels in the experiments were chosen from one hundred people, both male and female, who were strictly screened out from approximately one thousand people, the screening being based on their sensitivity of taste.

Experiment 1

The potency and quality of sweetness of saccharin and D- or DL-tryptophan:

The potency of an aqueous solution of an individual sweetener was measured in comparison with sucrose, and the results are given in the following Table 1. The measurement was accomplished by repeatedly obtaining the points of subjective equality between the above-mentioned sweeteners and sucrose with the participation of 25—50 panel members. In the experiment, a test solution was paired in turn with several concentrations (5—7 grades) of sucrose solution and these pairs of samples were presented at random. Then, the panelists were asked to indicate which one in each pair had a stronger sweetness. The data obtained were analyzed by the probit method and the sweetness of the test sample was represented by the concentration of sucrose required to attain an equivalent sweetness to the test sample. Only the final data are shown in Table 1.

[Price 25p]

TABLE 1

Sweet substance	Equivalent concentration of the present sweeteners and sucrose (g/dl)				
	0.005	0.01	0.02	0.04	0.08
Sodium Saccharin	0.005	0.01	0.02	0.04	0.08
Sucrose	2.2	3.5	5.5	7.4	9.2
D-tryptophan	0.05	0.1	0.2	—	—
Sucrose	3.0	5.1	8.5	—	—
DL-tryptophan	0.05	0.1	0.2	—	—
Sucrose	1.5	2.8	4.9	—	—

When comparison is made with sucrose as the basic material, with regard to the potency of the sweet materials, the potency of both saccharin and tryptophan fails to keep pace with increases in concentration. In addition, the potency of bitterness increases to an unfavourable extent when the concentration of those sweet materials become higher. Therefore, it is apparently difficult to get an increased potency of sweetness without an accompanying unfavourable bitterness.

The potency of sweetness of DL-tryptophan is about $\frac{1}{2}$ that of D-tryptophan.

15 Experiment 2
Taste of sodium saccharin and D- or DL-tryptophan:

Test solutions containing different concentrations of sodium saccharin, DL-tryptophan or D-tryptophan (as shown in the following Table 2) were prepared, and the degree of bitterness or unfavourable taste of each solution was checked by an organoleptic test with the participation of 15 panel members.

The organoleptic test was performed by requesting the panel members to point out the degree of bitterness shown hereunder (ranking method).

	marks
A: no bitter taste	0
B: slightly bitter taste	1
C: bitter taste	2
D: strongly bitter taste	3

20

25

30

TABLE 2

Potency of bitterness or unfavourable taste of sodium saccharin and D- or DL-tryptophan

Against the letters A, B, C and D are the numbers of persons who chose that particular degree of bitterness, there being a total of 15 persons in each vertical column.

Judgement	Sample: Concentration: (g/dl)	sodium saccharin				DL-tryptophan			D-tryptophan	
		0.01	0.02	0.04	0.08	0.05	0.1	0.2	0.05	0.1
A		8	6	1	1	9	6	2	10	7
B		5	8	7	3	3	4	3	4	4
C		2	1	5	5	2	3	4	0	2
D		0	0	2	6	1	2	6	1	2
\bar{X}		0.60	0.67	1.53	2.07	0.67	1.07	1.93	0.47	0.93

\bar{X} = average marks awarded per person for a particular solution, corresponding to the estimated degree of bitterness of that particular solution.

Experiment 3

Synergistic effect of sweetness between sodium saccharin and D- or DL-tryptophan:

- 5 A test was made in order to ascertain whether the mixture of sodium saccharin and D- or DL-tryptophan could produce a higher potency of sweetness than the sum of each potency. One would have imagined that the
- 10 potency of the mixture (in sucrose equivalents) would have been smaller than the sum of each potency in sucrose equivalents, because both saccharin and tryptophan belong to a

class whose potency of sweetness does not increase corresponding to increases in its concentration.

Comparison was made by 25 panel members regarding the intensity of sweetness between the mixture solution (S) and that of the sucrose solutions (T), the concentrations of the sucrose solutions being equal to or higher than the sum of each potency of the mixture (in sucrose equivalent). The results obtained are shown in the following Table 3.

TABLE 3

Sample to be compared (g/dl)		Result of judgment		
S	T (sucrose)	No. of persons who judged S>T	No. of persons who judged S<T	
sodium saccharin 0.01	6.5	25	0	+++
+	7	25	0	+++
D-tryptophan 0.05	8	24	1	+++
(in sucrose equivalent 3.5 + 3.0 = 6.5)	9	19	6	++
sodium saccharin 0.02	7	25	0	+++
+	8	20	5	++
DL-tryptophan 0.05	9	18	7	+
(in sucrose equivalent 5.5 + 1.5 = 7.0)				
sodium saccharin 0.02	8.3	25	0	+++
+	9	23	2	+++
DL-tryptophan 0.1	10	18	7	+
(in sucrose equivalent 5.5 + 2.8 = 8.3)				
sodium saccharin 0.01	8.5	12	13	—
+				
sucrose 5				
(in sucrose equivalent 3.5 + 5 = 8.5)				

Note: — : Not significant.

+: Significant at $p \leq 0.05$

++ : Significant at $p \leq 0.01$

+++ : Significant at $p \leq 0.001$

The potency of sweetness of sodium saccharin and D- or DL-tryptophan was calculated in terms of sucrose based on the results shown in Table 1.

- As apparent from Table 3, no special effect was observed in the combination of sodium saccharin and sucrose, while a remarkably synergistic effect was recognized between
- 30 sodium saccharin and D- or DL-tryptophan.

Experiment 4

Taste improvement by mixing sodium saccharin and D- or DL-tryptophan:

An organoleptic test by the ranking method was made by 15 panel members, in respect of

the potency of bitterness or unfavourable taste. The standard for appraisal is the same one as shown in Experiment 2. The concentration of each sample and experimental results are shown in the following Table 4, according to which significant differences were recognized by Friedman's test.

It is clear that the quality of taste can be improved when sodium saccharin and D- or DL-tryptophan are used in combination, especially when the concentration of sodium saccharin is more than 0.04 g/dl.

TABLE 4

Judgement	Sodium saccharin (g/dl)	0.02	0.04	0.08	0.02	0.04	0.08	0.08
	Try. (g/dl)	DL-try. 0.05			DL-try. 0.1			D-try. 0.05
A		9	6	4	8	7	4	5
B		4	7	7	5	6	6	7
C		2	2	2	2	1	3	2
D		0	0	2	0	1	2	1
\bar{X}		0.53	0.73	1.13	0.60	0.73	1.20	0.93

Note: A, B, C, D and \bar{X} are as defined in Experiment 2, and the layout of Table 4 is similar to that of Table 2.

Experiment 5

The minimum effective amount of each component in the mixture:

An organoleptic test using the triangle method (as described in Manual of Sensory Testing Methods (1968), published by ASTM) was performed by 25 panel members in order to decide an effective range of combination rate. In this method, three test samples were presented simultaneously; two were the same containing a single substance, saccharin or tryptophan (C in Table 5), and the third contained both saccharin and tryptophan (S in Table 5). Each of the panelists were requested to point out a sample which he be-

lieved to be different from the others. By this test, the minimum amount of D- or DL-tryptophan which is effective to improve the taste when added to a solution of saccharin and also the minimum amount of sodium saccharin which is effective to improve the taste when added to a solution of D- or DL-tryptophan were examined.

As can be seen from the following Table 5, the effect obtained by mixing sodium saccharin and D- or DL-tryptophan was recognized over a wide range of combination rate. Namely, 0.05—100 parts of tryptophan (in D-tryptophan equivalent) can be used based on one part of sodium saccharin.

TABLE 5

Control (C) (g/dl)	Sample (S) (g/dl)		No. of persons who answered correctly	A preference was checked about a correct solver
				No. of persons who want S rather than C
sodium saccharin 0.02	C+DL-Try.	0.005	17 +++	15 ++
	C+DL-Try.	0.0025	14 +	12 +
	C+DL-Try.	0.00125	8 —	— —
	C+D-Try.	0.00125	15 ++	13 ++
sodium saccharin 0.05	C+DL-Try.	0.005	15 ++	12 +
	C+DL-Try.	0.0025	7 —	— —
	C+D-Try.	0.0075	17 +++	13 +
DL-Try. 0.1	C+saccharin	0.0005	17 +++	13 +
	C+saccharin	0.00025	6 —	— —
DL-Try. 0.2	C+saccharin	0.001	14 +	12 +
	C+saccharin	0.0005	8 —	— —
D-Try. 0.1	C+saccharin	0.0025	14 +	13 ++

WHAT WE CLAIM IS:—

1. A composition suitable for the sweetening of edible materials, which comprises a mixture of 1 part by weight of a saccharin, and from 0.05 to 100 parts by weight of D-tryptophan or from 0.10 to 200 parts by weight of DL-tryptophan.
2. A composition as claimed in Claim 1, wherein the saccharin is sodium saccharin.
3. A composition as claimed in Claim 1, substantially as described in any one of the foregoing Experiments.
4. A process for preparing a composition as claimed in Claim 1 or 2, which comprises

intimately mixing 1 part by weight of a saccharin with from 0.05 to 100 parts by weight of D-tryptophan or from 0.10 to 200 parts by weight of DL-tryptophan.

5. A method of sweetening edible materials, which comprises adding thereto an effective amount of a composition as claimed in Claim 1, 2 or 3.

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